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Final state radiation from high and ultrahigh energy neutrino interactions

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Charged leptons produced by high-energy and ultrahigh-energy neutrinos have a substantial probability of emitting prompt internal bremsstrahlung $\nu_\ell + N \to \ell + X + \gamma$. This can have important consequences for neutrino detection. We discuss observable consequences at high- and ultrahigh-energy neutrino telescopes and LHC's Forward Physics Facility. Logarithmic enhancements can be substantial (e.g.\ $\sim 20\%$) when either the charged lepton's energy, or the rest of the cascade, is measured. We comment on applications involving the inelasticity distribution including measurements of the $\nu/\bar{\nu}$ flux ratio, throughgoing muons, and double-bang signatures for high-energy neutrino observation. Furthermore, for ultrahigh-energy neutrino observation, we find that final state radiation affects flavor measurements and decreases the energy of both Earth-emergent tau leptons and regenerated tau neutrinos. Finally, for LHC's Forward Physics Facility, we find that final state radiation will impact future extractions of strange quark parton distribution functions. Final state radiation should be included in future analyses at neutrino telescopes and the Forward Physics Facility.

Mini Symposia (Invited Talks Only)

Authors: ZHOU, Bei (Fermilab); PLESTID, Ryan

Presenter: ZHOU, Bei (Fermilab)

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